

GAO

Report to the Chairman, Subcommittee
on Readiness, Committee on Armed
Services, House of Representatives

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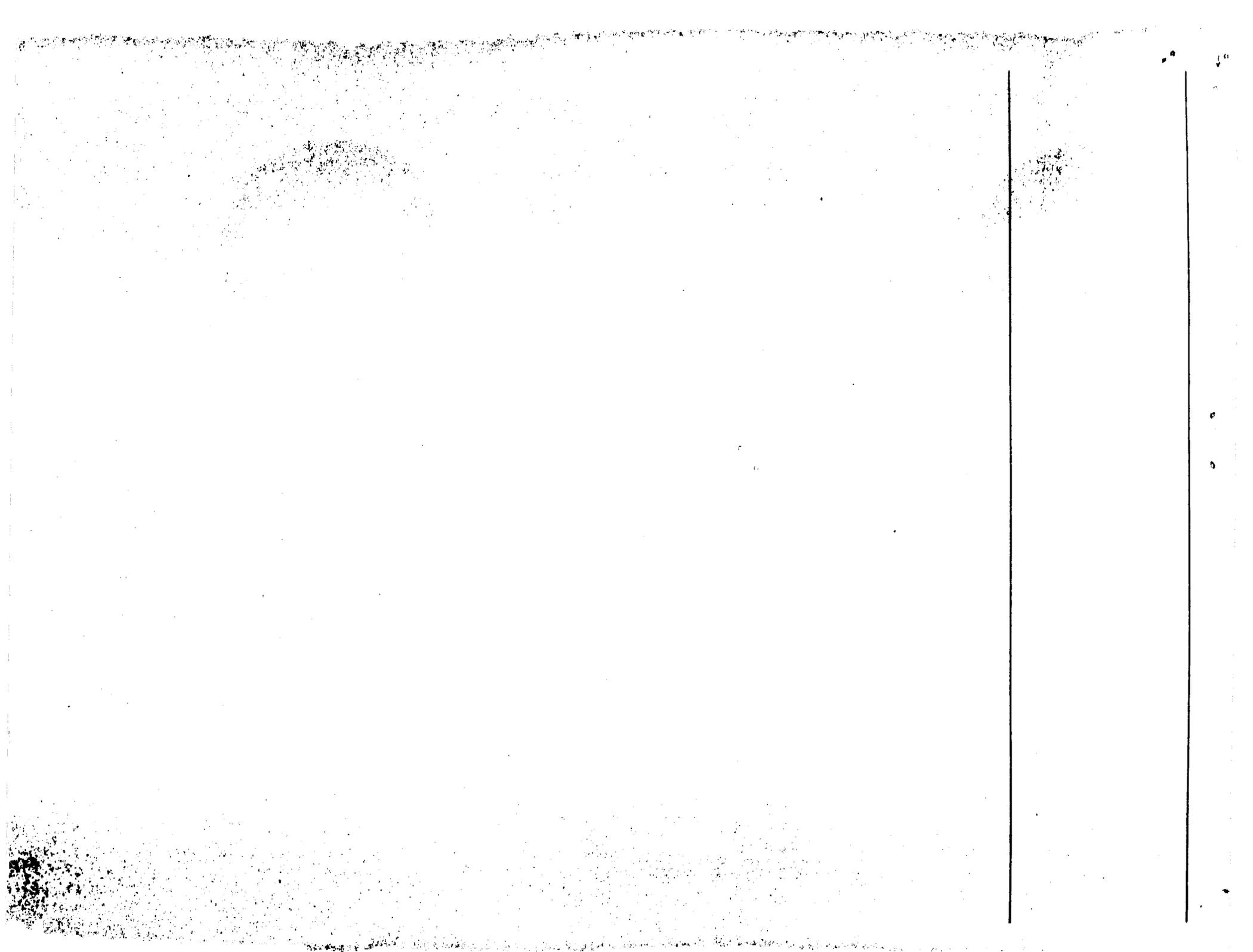
AIR FORCE ADP

Systems Funded Without Adequate Cost/Benefit Analyses



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Information Management and
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The Honorable Earl Hutto
Chairman, Subcommittee on Readiness
Committee on Armed Services
House of Representatives

Dear Mr. Chairman:

As requested by your predecessor, we reviewed the Air Force Logistics Command's development of four management information systems: (1) Air Force Equipment Management System (AFEMS), (2) Air Force Technical Order Management System (AFTOMS), (3) Automated Technical Order System (ATOS), and (4) Reliability and Maintainability Information System (REMIS). These four systems, estimated to cost \$435.6 million, are intended to improve the management of aircraft support equipment, maintenance data, and technical orders by replacing 38 outdated automated and manual systems.

The objective of our review was to determine if initial project planning weaknesses we previously identified in other system development projects were occurring in these four projects. We focused on the cost/benefit analyses the Command prepared when justifying and planning these projects. Appendix I contains additional information on our objective, and our scope and methodology.

Results in Brief

The cost/benefit analysis is intended to serve as a tool to help decision-makers select the best approach to satisfy mission needs. In three of the four projects, the Command performed inadequate cost/benefit analyses that, in essence, were no more than paper exercises. The fourth project is in the initial planning stage and the cost/benefit analysis is not complete.

The cost/benefit inadequacies fall under three categories. First, incomplete analyses of alternatives were performed. In one case, Air Force officials directed that an alternative be chosen; however, this system is currently being developed using one of the previously rejected alternatives. Second, benefits were overstated—the Command claimed these systems would provide \$8.4 billion in benefits but could not support any of this amount. Third, costs were understated—one analysis represented a system as costing \$21 million, but omitted additional costs of

up to \$132 million to load the data needed if the system is ever to provide any significant benefits.

Department of Defense and Air Force oversight officials acknowledge that more complete analyses could have been done, but believe the analyses performed met the minimum requirements needed to approve the projects. However, requirements are not met when the analyses present misleading information. The Air Force has consistently allowed systems to proceed into development without adequate cost/benefit analyses and these systems have experienced significant cost increases and schedule slippages. Therefore, this report includes recommendations to the Secretary of Defense and the Secretary of the Air Force to strengthen controls so that adequate cost/benefit analyses are performed before projects proceed into development.

Background

The Air Force Logistics Command supplies spare parts and provides depot-level maintenance to keep Air Force units and weapon systems in a state of readiness. The Command relies on computer technology to provide the enormous amount of information needed to accomplish its mission. Many of the Command's computer systems originated in the 1950s and 1960s, and, like other systems that date back to this era, have not kept pace with advances in computer technology.

In the early 1980s, the Air Force initiated several individual projects to modernize its automated logistics systems. In 1984, the Department of Defense authorized the Command to combine nine separate system development projects intended to improve aircraft maintenance and supply operations into a single program, the Logistics Management System Modernization Program. Since May 1987, we have issued three reports¹ on the Command's efforts to develop systems under the modernization program. In all three reports, we identified inadequacies in the Command's cost/benefit analyses. For example, we found projected program benefits were based on invalid assumptions and could not be supported. We also found that the cost of the modernization program has increased from \$715 million to nearly \$1 billion and scheduled completion has slipped 4 years.

¹Air Force Computers: Development Risks of Logistics Modernization Program Can Be Reduced (GAO/IMTEC-87-19, May 15, 1987); Air Force ADP: Logistics System Modernization Costs Continue to Increase (GAO/IMTEC-89-7FS, Dec. 28, 1988); and Air Force ADP: Evaluations Needed to Substantiate Modernization Program Benefits (GAO/IMTEC-89-29, May 5, 1989).

As a follow-up to our work in the above reports, the Subcommittee asked us to review four additional system development projects managed by the Command. While these four projects are not part of the Logistics Management Systems modernization program, they are part of the Air Force's overall efforts to modernize its management systems. The four projects addressed in this report—AFEMS, ATOS, AFTOMS, and REMIS—are described in more detail in appendix II.

These four projects, which are intended to help the Command improve its management of aircraft support equipment, technical orders, and maintenance data, are expected to cost \$435.6 million and take 5 or more years to complete. Table 1 below shows start and estimated completion dates, the amount of money obligated, and estimated total costs for each project as of June 30, 1989.

Table 1: Status of System Development Projects

Dollars in millions

Project	Start date ^a	Estimated completion date	Obligations	Estimated acquisition cost
AFEMS	October 1986	July 1993	\$5.1	\$78.3
REMIS	October 1984	Unknown ^b	55.0	86.1
ATOS	October 1982	March 1987 ^c	21.7	21.7
AFTOMS	October 1988	August 1995	4.9	249.5
Total			\$86.7	\$435.6

^aThese dates are when funds were first obligated for the systems.

^bAs of August 10, 1989, system development has been suspended for one of its four subsystems.

^cThe Command considers system development completed; however, all data has not been loaded into the system and the system is not operating at expected levels.

The level of oversight and approval responsibility for these, as well as other defense system projects, depends on the cost of, or interest in, the project. AFTOMS, with an estimated acquisition cost of \$249.5 million, is designated as a major² system and is under the responsibility of the Secretary of Defense through the Major Automated Information Systems Review Council. The Council reviews projects and must approve any decision to proceed to the next stage. AFEMS, REMIS, and ATOS are not considered major systems. REMIS is under the responsibility of the Secretary of the Air Force as a special-interest project. AFEMS and ATOS are under the Command's responsibility.

²Defense Directive 7920.1 defines major systems as those with estimated acquisition costs over \$100 million, those with estimated costs in any 1 year exceeding \$25 million, or those designated as special interest.

Cost/Benefit Analyses Were Deficient

The cost/benefit analyses performed for three of the four projects—AFEMS, REMIS, and ATOS—were deficient in two areas: (1) all feasible alternatives were not analyzed as required; and (2) expected benefits were not adequately supported. Further, one project's costs were significantly understated. The cost/benefit analysis for the fourth project—AFTOMS—is not finished.

System Development Alternatives Were Not Completely Analyzed

In order to provide the information needed to help select the optimal system alternative, the cost/benefit analysis must consider a full range of alternatives. The analyses performed on three of the four current projects—AFEMS, REMIS, and ATOS—included only the existing system and one alternative, even though the Command identified several feasible alternatives for each project.

Department of Defense Instruction 7041.3 and Air Force Regulation 173-15 require that, during system development, a complete cost/benefit analysis be performed that identifies and analyzes all feasible alternatives. This guidance states that it is “imperative to consider a full range of alternatives” so the decision-maker will have the information needed to select the most cost-effective option available. This guidance, as a minimum, allows a full comparison of the current system with one alternative if only one alternative is available.

The Command completed a cost/benefit analysis for each of the three projects and each analysis identified several feasible alternatives, but did not include a comparison of the costs and benefits of these alternatives as required by Air Force policy. Instead, these analyses included only cost and benefit estimates for the continued operation of the current system and the cost for one alternative. For example, although three feasible alternatives were identified for REMIS, the cost and benefits of only one alternative—a distributed processing system—was analyzed. The other alternatives—a centralized processing system and a weapon-system unique system—were mentioned in the economic analysis, but cost and benefit estimates were not shown.

AFEMS and REMIS project officials stated they did not analyze a full range of alternatives because they believed Air Force regulations require analysis of a minimum of two alternatives (the current system plus one alternative) and they saw no need for analyzing other alternatives. These officials further stated that they were directed by Air Force headquarters to use a particular alternative, so there was no need to cost out the others. According to Command officials, the REMIS alternatives, a

centralized processing system and a weapon-system unique system, were not feasible. However, REMIS is currently being implemented using the discarded centralized processing approach. ATOS officials were unable to explain why they had not fully analyzed all feasible alternatives because the rationale for the decision was not documented and the staff who made that decision were no longer with the program office.

Command officials acknowledged that a more complete analysis could have been done on these projects, but they felt they had complied with Air Force regulations which they believe require an analysis of at least the current system and one alternative. Air Force regulations, however, indicate that the current system and just one alternative should be analyzed only when no other feasible alternatives exist.

Both Air Force headquarters and Department of Defense review and oversight officials said, for all system developments, they expected a full cost and benefit comparison of all feasible alternatives, with a minimum of at least three alternatives presented, when possible. These officials stated that they recognize past cost/benefit analyses have not been done as well as they should be, and they will ensure that future analyses are more comprehensive and accurate.

Estimated Benefits Not Supported

A clear presentation of expected benefits should be a key factor for determining whether a proposed system development is justified and should be approved. Defense directives and Air Force regulations require that expected benefits from new systems clearly identify the extent to which existing system deficiencies will be corrected and Command operations improved. Documentation supporting this analysis must include both the computations used to derive benefits and a detailed description of the estimating methodology.

The Command, in its cost/benefit analyses of the AFEMS, ATOS, and REMIS projects, claimed that the new systems would provide about \$8.4 billion in benefits; however, these estimated benefits were not supported. For each project, the following table shows the benefits claimed, the portion of these benefits that the Command adequately supported, and the unsupported portion.

Table 2: Comparison of Estimated Benefits

Dollars in millions

Project	Command estimates	Substantiated estimates	Unsupported estimates
AFEMS	\$3,353.5	0	\$3,272.0 ^a
ATOS	38.4	0	38.4
REMIS	4,970.9	106.4 ^b	4,970.9
Total	\$8,362.8	\$106.4	\$8,281.3

^aThe Command claimed additional benefits of \$81.5 million; however, we did not evaluate the support for these benefits.

^bThese benefits were not part of the Command's original projections, but were identified by the Air Force Audit Agency in a subsequent audit.

An example of unsupported benefits is the Command's estimate that AFEMS would result in \$3.4 billion in benefits. The Command's support for these benefits is based on an assumption that the more accurate data expected to be provided by the new system would eliminate overstated support equipment purchase requirements and save about \$2.2 billion in unnecessary expenditures over an 8-year period. However, inaccurate data was only one of five factors that caused the requirements to be overstated and project officials do not know the extent to which any of the factors contributed. While AFEMS may improve the accuracy of data, the other four factors—changes in contract unit costs, unobligated balances, multi-year funding requirements, and procurement ceiling limitations—will continue to contribute to overstated requirements. We discussed our findings with Command Comptroller officials and they agreed that the assumptions underlying the claimed benefits were weak.

Air Force Audit Agency reviews³ of ATOS and REMIS revealed that these benefit estimates were also unsupported. The Audit Agency concluded that some operational improvements would probably result from REMIS, but none of the Command's \$5 billion in projected benefits could be supported. In fact, the Audit Agency found that some of these benefits had already been claimed in justifying another logistics system development project. The Audit Agency did identify about \$106.4 million in other benefits for REMIS; namely, fewer systems analysts, the elimination of additional data systems, and reduced communications costs, none of which were included in the Command's cost/benefit analysis.

³Review and Analysis of Benefits Expected From Phase I of the Automated Technical Order System (ATOS), Air Force Audit Agency, October 14, 1988; and Review and Analysis of the Benefits Expected From Implementation of the Reliability and Maintainability Information System, Air Force Audit Agency, November 17, 1988.

Similarly, we were unable to find support for the Command's estimate of \$38.4 million in projected benefits for ATOS. In addition, the Air Force Audit Agency found no benefits or operational improvements are possible unless existing technical orders are loaded into the system. However, the Command has made little progress loading this data. ATOS development was completed over 2 years ago and only about 5 percent of more than 4 million pages of data have been loaded.

Project management officials agree that some benefit estimates are not well supported, but stated that the estimates were the best that could be made because pertinent data, staff available to make the analyses, and funding were limited. The officials added that they still believe the projects are beneficial because they will provide benefits such as more accurate data and more timely updates.

Project Costs Were Significantly Understated

Defense Instruction 7041.3 directs that all resources required to achieve stated objectives be shown in the cost analysis and that life cycle costs include all anticipated expenditures directly or indirectly associated with an alternative.

The Command significantly understated the estimated costs of the ATOS project by not including in its cost/benefit analysis all associated costs. The Command approved and funded the ATOS project at an estimated cost of \$21.7 million. However, between \$50 and \$132 million (or up to six times the cost of developing ATOS) will be needed to input orders and load them into the system. To date, only a small portion of the technical order data has been loaded.

The AFTOMS project, which is still in the system concept stage, will also require the input of information from millions of pages of technical orders and management data. Command officials estimate that it will cost about \$100 million to load the technical orders, yet these costs were not included in the Command's projected AFTOMS acquisition costs of \$250 million.

A Command official stated that data loading costs were not included in the cost/benefit analysis for the ATOS project because they considered these costs a user responsibility. However, Defense instructions require that all costs directly or indirectly related to a system alternative be included in estimates. More importantly, without a complete presentation of costs, decision-makers do not have sufficient information to make funding decisions on proposed projects.

Cost/Benefit Analyses Should Be Revised

Air Force regulation 173-5 states that a project's cost/benefit analysis must be revised if a significant adjustment to an ongoing project is necessary. In one of the four projects, REMIS, significant changes have occurred and, therefore, the cost/benefit analysis should be revised.

REMISS's acquisition costs are expected to increase because of a 1988 budget reduction of \$13.3 million, which caused work to stop on three of its four subsystems. As of August 1989, work has resumed on two of the three interrupted subsystems. Program office officials estimate that it will now cost \$20 million to finish development of REMIS (restoration of the \$13.3 million plus an additional \$6.7 million). According to an Air Force Audit Agency official, the benefits claimed for REMIS will be significantly reduced if the system is not in full operation in 1990. REMIS officials recently estimated that full operating capability might be delayed until 1995. The officials also estimated that this delay would cost \$20 million to continue operating the systems REMIS was intended to replace.

Conclusions

Because the Command continues to perform inadequate cost/benefit analyses for automated systems, it cannot determine whether the projects are economically justified or whether it is pursuing the most cost-effective alternatives for achieving objectives. We have previously reported that cost/benefit weaknesses existed in six of the Command's nine Logistics Management Systems projects. Several of these projects have experienced significant cost increases and schedule slippages and the development approaches have had to be restructured and redirected. The cost/benefit analyses for three of the projects we reviewed did not include an assessment of all feasible alternatives, contained unsupported benefits, and, in one case, did not include all costs. The absence of a comprehensive, complete, and fully-supported cost/benefit analysis prevents decision-makers from comparing program alternatives and selecting the most cost-effective solution. The cost/benefit analysis for the fourth project we reviewed has not yet been completed.

Additionally, the Command continues to approve projects with cost/benefit analyses that lack support for benefits claimed even though the determination of benefits is a key factor for deciding whether a proposed system development project is justified. If benefits are overstated, top management has misleading information with which to help evaluate whether a proposed system development project should be approved.

The Air Force has consistently allowed systems to proceed into development with deficient cost/benefit analyses. To avoid the problems that such systems encounter, the Secretary of Defense and the Secretary of the Air Force need to take action to help ensure that cost/benefit analyses (1) cover a full range of alternatives, (2) show only well-supported benefits, and (3) accurately present costs.

Recommendations

To help ensure that cost/benefit analyses for all Air Force system projects identify the most cost-effective approach, we recommend that the Secretary of Defense strengthen controls so that future analyses include: (1) an economic evaluation of all feasible alternatives, (2) only projected benefits that are fully supported and verified by an independent source, such as the Air Force Audit Agency, and (3) all data conversion costs.

To ensure that current management has sufficient information on which to make a decision on the AFTOMS project, we recommend that the Secretary of Defense not allow that system to proceed into development until the Command performs a complete and comprehensive cost/benefit analysis. This analysis should include an evaluation of all feasible alternatives and, for each, all direct and indirect costs including all data loading costs and all supported benefits. Defense's Major Automated Information Systems Review Council should ensure the adequacy of this analysis before approving the system for development.

To determine if continued development is justified, we recommend that the Secretary of the Air Force reevaluate the cost-effectiveness of AFEMS and REMIS by updating the cost/benefit analyses. The Secretary should ensure the adequacy of these analyses before allowing the projects to proceed.

In light of the additional data loading costs for ATOS, the Secretary of the Air Force should reevaluate this system to determine if the projected benefits justify the additional costs.

In accordance with your wishes, we did not obtain official agency comments on this report. We did, however, discuss its contents with Air Force and Department of Defense officials and have included their comments where appropriate. We performed our work between May 1988 and October 1989, in accordance with generally accepted government auditing standards.

As agreed with your office, unless you publicly announce its contents earlier, we plan no further distribution of the report until 30 days from the date of this letter. At that time, we will provide copies of this report to the Secretary of Defense and the Secretary of the Air Force. We will also make copies available to other interested parties upon request. This work was performed under the direction of Samuel W. Bowlin, Director, Defense and Security Information Systems, who can be reached at (202) 275-4649. Other major contributors are listed in appendix III.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Ralph V. Carlone". The signature is fluid and cursive, with the first name "Ralph" being the most prominent.

Ralph V. Carlone
Assistant Comptroller General

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Abbreviations

ADP	automated data processing
AFEMS	Air Force Equipment Management System
AFTOMS	Air Force Technical Order Management System
ATOS	Automated Technical Order System
GAO	General Accounting Office
IMTEC	Information Management and Technology Division
REMIS	Reliability and Maintainability Information System

Objective, Scope, and Methodology

At the request of the former Chairman, Subcommittee on Readiness, House Committee on Armed Services, we reviewed four Air Force Logistics Command projects to develop new automated systems. Our objective was to determine if initial planning weaknesses, such as those identified in previous reports, were occurring in these four system development projects. The four projects we reviewed were (1) Air Force Equipment Management System (AFEMS), (2) Air Force Technical Order Management System (AFTOMS), (3) Automated Technical Order System (ATOS), and (4) Reliability and Maintainability Information System (REMIS). We focused on the cost/benefit analyses the Command prepared when justifying and planning three of these four projects. The fourth project we reviewed is still in the initial planning phase and the cost/benefit analysis is not complete.

To determine whether the four projects will likely achieve expected benefits and mission improvements, we evaluated the Air Force's initial benefit estimates, where available. In addition, we evaluated the Command's supporting documentation, discussed the benefits with the Command officials, and reviewed project status reports. We also analyzed recent Air Force Audit Agency assessments of the Command's documentation of ATOS and REMIS' benefit estimates. We reviewed the Audit Agency's workpapers and discussed these with Audit Agency officials. For comparison purposes, we adjusted the computed benefits for each project to cover a standard 8-year useful operation life using guidance in Air Force Regulation 173-15, Economic Analysis and Program Evaluation for Resource Management. Department of Defense and Air Force guidance were used as criteria to evaluate project benefits.

To evaluate the adequacy of the Command's initial planning for AFEMS, ATOS, and REMIS, we reviewed the feasibility studies and economic analyses for each of the three projects. We received briefings from and interviewed project office and headquarters officials and officials from the Office of the Assistant Secretary of Defense. We used as criteria Department of Defense instructions along with Air Force regulations and guidance governing the initiation, approval, and management of automated information systems developments.

To determine the costs and schedules for AFEMS, AFTOMS, ATOS, and REMIS, we obtained and analyzed current project status reports and discussed these with Command officials who manage and develop the projects.

Our review was conducted from May 1988 to October 1989, primarily at the Logistics Management Systems Center of the Air Force Logistics

Command, the Office of the Deputy Chief of Staff for Material Management; the Office of the Deputy Chief of Staff, Comptroller; and the AFTOMS, ATOS, AFEMS, and REMIS project offices at Wright-Patterson Air Force Base, Dayton, Ohio. We also visited the Air Force Audit Agency at Wright-Patterson Air Force Base and the Air Logistics Centers in San Antonio, Texas, and Warner Robins, Georgia. Our work also included discussions with Office of the Assistant Secretary of Defense and Air Force Headquarters officials in Washington, D.C.

In accordance with your wishes, we did not obtain official agency comments on this report. However, we discussed the facts with Defense and Air Force officials and have included their comments where appropriate. We performed our work in accordance with generally accepted government auditing standards.

Project Description and Status (As of June 30, 1989)

Air Force Equipment Management System (AFEMS)

AFEMS is intended to provide an inventory of operation and maintenance equipment for use by the major commands to budget, compute requirements, authorize and account for support equipment assets, and forecast future needs. AFEMS will replace 10 existing batch systems with a single on-line system. This project originated in 1986 to improve (1) data accuracy and consistency, (2) timeliness, and (3) responsiveness to user requirements. The program office is currently reviewing contractor proposals, with contract award scheduled for December 1989.

Air Force Technical Order Management System (AFTOMS)

AFTOMS is intended to automate the development, acceptance, storage, and management of technical orders and their distribution. The project was initiated in 1988 and will encompass all personnel, policies and directives, and the manual and automated systems currently used to manage technical orders. The Command is currently developing the system, with contract award planned for March 1991.

Automated Technical Order System (ATOS)

ATOS will provide a system to automate changes to technical orders. In addition, ATOS is expected to produce existing Air Force publications in a more accurate and timely manner, through automated text and graphics applications. The ATOS project was initiated in 1982 to improve the timeliness and accuracy of technical orders. The Air Force Command has designated this system fully operational; however, it cannot achieve planned production rates until up to 4 million pages of existing technical orders are input into the system. The Command has no formal plans or approved funds for inputting this data. However, some Air Logistics Centers have been able to input minor amounts of their data by redirecting funds from other sources. As of October 31, 1989, the Centers have only loaded 205,389 pages.

Reliability and Maintainability Information System (REMIS)

REMIS is intended to collect equipment maintenance data on aircraft and other weapon systems. The maintenance data will be used to track reliability, maintainability, and warranty information for equipment failures and suggest appropriate corrective actions. The system is also expected to provide information to help identify mission capability and aircraft awaiting parts. REMIS will replace 26 existing batch systems with a single on-line system. The REMIS project originated in 1984 to improve the availability, accuracy, and flow of equipment maintenance information.

There is no scheduled date for system completion because part of the project was suspended due to a funding shortfall. A new schedule will be established when contract renegotiations are complete.

Project Schedule Status

Department of Defense and Air Force regulations require a structured process for planning, developing, reviewing, and approving information system development projects. This process is designed to control, manage, and evaluate a project to minimize the cost and performance risks associated with acquiring an effective system and is divided into four broad phases, each phase culminating in a milestone decision point. The phases are (1) concept development (milestone 0); (2) definition/design (milestone I), (3) system development (milestone II); and (4) deployment/operation (milestone III). Table II.1 below shows the key dates and milestones for each of the four projects.

Table II.1: Project Approval Milestones

System development phases and milestones	AFEMS	ATOS ^a	AFTOMS	REMIS
Concept development approval (milestone 0)	February 1988	Not required	May 1989	May 1985
Definition/design approval (milestone I)	February 1988	Not required	March 1990	November 1985
System development approval (milestone II)	December 1990	Not required	March 1992	June 1987
Deployment/operation approval (milestone III)	June 1992	Not required	July 1993	To be determined
Full operational capability	July 1993	March 1987	August 1995	To be determined

^aBecause of its initial cost and size did not require milestone reviews and approval.

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